

WHAT IS CLAIMED IS:

1 1. For use in a digital data communications system
2 comprising a channel encoder, an apparatus for use as a channel
3 encoder, said apparatus comprising:

4 a first Turbo encoder capable of Turbo encoding data;

5 an interleaver unit coupled to said first Turbo encoder, said
6 interleaver unit capable of interleaving Turbo encoded data from
7 said first Turbo encoder; and

8 a second Turbo encoder coupled to said interleaver unit, said
9 second Turbo encoder capable of Turbo encoding interleaved data
10 from said interleaver unit.

1 2. The apparatus as set forth in Claim 1 further comprising
2 a symbol puncture and repetition unit coupled to said second Turbo
3 encoder, said symbol puncture and repetition unit capable of
4 puncturing and repeating Turbo encoded data from said second Turbo
5 encoder.

1 3. The apparatus as set forth in Claim 2 wherein said
2 apparatus is capable of providing a packet data error rate less
3 than one percent (1%) when 64-QAM RF modulation is used.

1 4. The apparatus as set forth in Claim 1 wherein said first
2 Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 5. The apparatus as set forth in Claim 1 wherein said second
2 Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 6. For use in a digital data communications system
2 comprising a channel encoder, an apparatus for use as a channel
3 encoder, said apparatus comprising:

4 a first Turbo encoder capable of Turbo encoding data, wherein
5 said first Turbo encoder is capable of receiving data from a source
6 encoder of said digital data communications system;

7 an interleaver unit coupled in parallel with said first Turbo
8 encoder, wherein said interleaver unit is capable of receiving data
9 from said source encoder of said digital data communications
10 system, and wherein said interleaver unit is capable of
11 interleaving said data from said source encoder;

12 a second Turbo encoder capable of Turbo encoding data, wherein
13 an input of said second Turbo encoder is coupled to an output of
14 said interleaver unit, and wherein said second Turbo encoder is
15 capable of Turbo encoding interleaved data from said interleaver
16 unit; and

17 a multiplexer having a first input coupled to an output of
18 said first Turbo encoder and having a second input coupled to an
19 output of said s coupled to said first Turbo encoder, said
20 multiplexer capable of multiplexing data from said first Turbo
21 encoder and from said second Turbo encoder.

1 7. The apparatus as set forth in Claim 6 further comprising
2 a symbol puncture and repetition unit having an input coupled to an
3 output of said multiplexer, said symbol puncture and repetition
4 unit capable of puncturing and repeating multiplexed data from said
5 multiplexer.

1 8. The apparatus as set forth in Claim 6 wherein said first
2 Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 9. The apparatus as set forth in Claim 6 wherein said second
2 Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 10. A digital data communications system comprising a channel
2 encoder comprising:

3 a first Turbo encoder capable of Turbo encoding data from a
4 source encoder of said digital data communications system;

5 an interleaver unit coupled to said first Turbo encoder, said
6 interleaver unit capable of interleaving Turbo encoded data from
7 said first Turbo encoder; and

8 a second Turbo encoder coupled to said interleaver unit, said
9 second Turbo encoder capable of Turbo encoding interleaved data
10 from said interleaver unit.

1 11. The digital data communications system as set forth in
2 Claim 10 wherein said channel encoder further comprises a symbol
3 puncture and repetition unit coupled to said second Turbo encoder,
4 said symbol puncture and repetition unit capable of puncturing and
5 repeating Turbo encoded data from said second Turbo encoder.

1 12. The digital data communications system as set forth in
2 Claim 10 wherein said first Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 13. The digital data communications system as set forth in
2 Claim 10 wherein said second Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 14. A digital data communications system comprising a channel
2 encoder comprising:

3 a first Turbo encoder capable of Turbo encoding data, wherein
4 said first Turbo encoder is capable of receiving data from a source
5 encoder of said digital data communications system;

6 an interleaver unit coupled in parallel with said first Turbo
7 encoder, wherein said interleaver unit is capable of receiving data
8 from said source encoder of said digital data communications
9 system, and wherein said interleaver unit is capable of
10 interleaving said data from said source encoder;

11 a second Turbo encoder capable of Turbo encoding data, wherein
12 an input of said second Turbo encoder is coupled to an output of
13 said interleaver unit, and wherein said second Turbo encoder is
14 capable of Turbo encoding interleaved data from said interleaver
15 unit; and

16 a multiplexer having a first input coupled to an output of
17 said first Turbo encoder and having a second input coupled to an
18 output of said s coupled to said first Turbo encoder, said
19 multiplexer capable of multiplexing data from said first Turbo
20 encoder and from said second Turbo encoder.

1 15. The digital data communications system as set forth in
2 Claim 14 wherein said channel encoder further comprises a symbol
3 puncture and repetition unit having an input coupled to an output
4 of said multiplexer, said symbol puncture and repetition unit
5 capable of puncturing and repeating multiplexed data from said
6 multiplexer.

1 16. The digital data communications system as set forth in
2 Claim 14 wherein said first Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 17. The digital data communications system as set forth in
2 Claim 14 wherein said second Turbo encoder comprises:

3 a first convolutional encoder capable of convolutionally
4 encoding data;

5 an interleaver unit coupled to said first convolutional
6 encoder, said interleaver unit capable of interleaving
7 convolutionally encoded data from said first convolutional encoder;
8 and

9 a second convolutional encoder coupled to said interleaver
10 unit, said second convolutional encoder capable of convolutionally
11 encoding interleaved data from said interleaver unit.

1 18. For use in a digital data communications system
2 comprising a channel encoder, a method of operating said channel
3 encoder, said method comprising the steps of:

4 encoding data with a first Turbo encoder;

5 interleaving Turbo encoded data from said first Turbo encoder
6 with a first interleaver unit; and

7 encoding interleaved data from said first interleaver unit
8 with a second Turbo encoder.

1 19. The method as set forth in Claim 18 further comprising
2 the step of:

3 puncturing and repeating Turbo encoded data from said second
4 Turbo encoder in a symbol puncture and repetition unit coupled to
5 said second Turbo encoder.

1 20. The method as set forth in Claim 18 wherein said step of
2 encoding data with a first Turbo encoder comprises the steps of:
3 convolutionally encoding data in a first convolutional
4 encoder;

5 interleaving convolutionally encoded data from said first
6 convolutional encoder in a second interleaver unit coupled to said
7 first convolutional encoder; and

8 convolutionally encoding interleaved data from said second
9 interleaver unit in a second convolutional encoder coupled to said
10 second interleaver unit.

1 21. The method as set forth in Claim 18 wherein said step of
2 encoding interleaved data from said first interleaver unit with a
3 second Turbo encoder comprises the steps of:

4 convolutionally encoding interleaved data from said first
5 interleaver unit in a first convolutional encoder;

6 interleaving convolutionally encoded data from said first
7 convolutional encoder in a second interleaver unit coupled to said
8 first convolutional encoder; and

9 convolutionally encoding interleaved data from said second
10 interleaver unit in a second convolutional encoder coupled to said
11 second interleaver unit.

1 22. For use in a digital data communications system
2 comprising a channel encoder, a method of operating said channel
3 encoder, said method comprising the steps of:

4 encoding data from a source encoder of said digital data
5 communications system with a first Turbo encoder;

6 interleaving data from a source encoder of said digital data
7 communications system with a first interleaver unit coupled in
8 parallel with said first Turbo encoder;

9 encoding interleaved data from said first interleaver unit
10 with a second Turbo encoder coupled to said first interleaver unit;
11 and

12 multiplexing interleaved data from said first interleaver unit
13 and Turbo encoded data from said first Turbo encoder in a
14 multiplexer coupled to said first interleaver unit and to said
15 first Turbo encoder.

1 23. The method as set forth in Claim 22 further comprising
2 the step of:

3 puncturing and repeating multiplexed data from said
4 multiplexer in a symbol puncture and repetition unit coupled to
5 said multiplexer.

1 24. The method as set forth in Claim 22 wherein said step of
2 encoding data from a source encoder of said digital data
3 communications system with a first Turbo encoder comprises the
4 steps of:

5 convolutionally encoding said data from said source encoder in
6 a first convolutional encoder;

7 interleaving convolutionally encoded data from said first
8 convolutional encoder in a second interleaver unit coupled to said
9 first convolutional encoder; and

10 convolutionally encoding interleaved data from said second
11 interleaver unit in a second convolutional encoder coupled to said
12 second interleaver unit.

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1 25. The method as set forth in Claim 22 wherein said step of
2 encoding interleaved data from said first interleaver unit with a
3 second Turbo encoder comprises the steps of:

4 convolutionally encoding interleaved data from said first
5 interleaver unit in a first convolutional encoder;

6 interleaving convolutionally encoded data from said first
7 convolutional encoder in a second interleaver unit coupled to said
8 first convolutional encoder; and

9 convolutionally encoding interleaved data from said second
10 interleaver unit in a second convolutional encoder coupled to said
11 second interleaver unit.